International Journal of Zoology
and Research (IJZR)
ISSN(P): 2278-8816; ISSN(E): 2278-8824
Vol. 4, Issue 3, Jun 2014, 99-106

COMMON ENDOPARASITES OF WILDROCK PIGEON (*COLUMBA LIVIA LIVIA*) AND WOOD PIGEON (*COLUMBA PALUMBUS*) IN THE ALGIERS SAHEL, ALGERIA

Y. DJELMOUDI[1], A. MILLA[2], S. DAOUDI-HACINI[3] & S. DOUMANDJI[4]

[1,3,4]Ecole nationalesupérieure Agronomique, Département de Zoologieagricoleetforestière, El Harrach, Alger, Algeria

[2]Ecole nationalesupérieureVétérinaired'Alger, El-Harrach, Alger, Algeria

ABSTRACT

The one year study reported in this article took place from March 2013 to February 2014 on the wild pigeons (wildrock and woodpigeons) of the AlgiersSahel (Algeria) to determine the occurrence of the endoparasites species (coccidia and helminths) and to evaluate the kind, sex and season effects on the prevalence and the intensity. Faecal samples were taken on 232 wild pigeons (136 rock pigeons and 115 wood pigeons). These samples were examined via the centrifugal flotation method using the Sheather's saturatesugar solution. Oocysts of coccidia were detected in 36 (59%)rock pigeons and in 30 (88,2%) wood pigeons. The coccidiaspecies identified in the rock pigeons were as follows: *Eimeria labbeana* (30%); *E. columbae* (25, 8%); and *E. columbarum* (18,3%). In the wood pigeons, the oocysts of the following species were detected: *Eimeria labbeana* (25%), *E. columbae* (21,4%), and *E. columbarum* (6,3%). Eggs of helminth were found in the faeces of 25 (41%) rock pigeons and in four (11, 8%) wood pigeons. The following species of helminth were identified: *Capillaria sp* (20,8%), *Ascaridia columbae* (4,2%), and *Heterakis sp* (2,5%) in the wild pigeons contrary to the wood pigeons in which, *Capillaria sp* (7,1%) was the sole species found. In contrast, when the infections were evaluated depending on the gender, it was found that the infection rates of males and females were very close to each other, which was statistically insignificant (P>0.05). The wild pigeons infection rate in autumn proved rather high comparatively with the wood pigeons infection rate (P<0.05).

KEYWORDS: Wild Rockpigeon, Wood Pigeon, Coccidia, Helminths, Sex, Season, Algiers Sahel

INTRODUCTION

Long time ago, Pigeons lived side by side with humans and other animal species in the nature; they were bred as a source of food, as a hobby, symbol, and for experimental aims (Cooper, 1984). In addition, they adapted to urban, suburban and rural environment where, they feed on a large variety offood articles including grains, ingots, worms of ground and insects (Adang, 1999). Thus, the importance of the pigeon's health should not be neglected. The wild pigeons are particularly concerned since they constitute a major reservoir of parasites, and play an important role in the transmission of parasitic diseases to poultry (Hall, 1952; Huchzermeyer, 1978; Cooper, 1984; Kaminjolo and Al, 1988; Piasecki, 2006; Opara et al., 2012).Several endoparasites are involved, causing morbidity and mortality to these birds (Cheng, 1973; Souls by, 1982). In much areas of the world, it was announced that coccidiose and helminth infections are common to pigeons (Hunt and O' grady, 1976; Levine, 1985; Soulsby, 1986; Kulisic, 1989; Harlin, 1994). The serious infections generally lead to weakness, loss of weight, weakens and diarrhoea (Cheng, 1973). Moreover, the prevalence and the intensity of these parasites of infestation can be influenced by several epidemiological factors including (the age, sex and the race) and environmental factors (climatic conditions) (Nadeem and Al, 2007).

This study aim to determine the prevalence of the possible parasites in the faecal samples of rock pigeons and woodpigeons in Algiers Sahel and to obtain information about the effects of some factors such as seasons and race on the parasitic infections as well as the identification of the parasitic specific processions to the various species of pigeons which remains, however, a stage impossible to avoid in order to approach these problems. Such follow-ups also make it possible to improve our knowledge on the dynamic of pathogenic communities related to public health and/or veterinary issues. These analyses are the first of kind in Algeria on these reservoirs of parasites, of which, no regulation is envisaged for the transmission risks to humans or domestic animals.

MATERIALS AND METHODS

Study Area

This study was led in the area of Algiers Sahel. It includes all the small reliefs which extend between Bouzaréah in the north, the left banks of El-Harrach river at the south-east and the right bank of the Mazafran river in south-west (Benallal and Ourabia, 1988). The zones particularly frequented by the birds object of this study, are represented by suburban environments as well as natural environments. The bioclimatic stage of this area is semi-arid characterized by a warm winter.

Collection of the Samples

Faecal samples were gathered from 235 wild pigeons (120 rock and 115 wood pigeons) between March 2013 and February 2014. The selection process was conducted aleatory by taking pigeons fixed on buildings roofs such as hospitals and schools within Algiers Sahel, and the hunting reserve of Zéralda concerning wood pigeons then, were put in separated camps in order to obtain faeces. Prior to pigeon's release, faecal samples were directly taken to laboratory.

Fecal Examination

After three washings, the deposit of each fecal sample was mixed to the Sheather's saturate sugar solution, centrifuged then examined under a microscope in order to determine the presence of protozoon oocysts. The samples containing the coccidian oocysts were mixed with dichromate of potassium (K2Cr2 O7) at 2, 5% in Petri dishes, then putted at an ambient temperature so that the sporulation of the oocysts would take place (Chermette and Bussieras, 1992).

The coccidian species identification was based on the oocysts morphological characteristic's using a microscope (Olympus) equipped with a camera (Levine, 1985; Pellerdy, 1974; Soulsby, 1986). The same procedure was applied to helminth eggs (Tinar, 2006).

Statistical Analyses

The collected data were entered in a traditional data base -processing Excel 2007. The checking and the statistical processing were conducted on Excel, Minitab® Release 14.1 (statistical software© 1972-2003 MinitabInc. All rights reserved Win 1410 ea. 30). Eventual differences were regarded as significant within an error risk of 5%.

RESULTS

Three coccidian species were detected in the faecal samples of rock pigeons and wood pigeons as well, while, three species of helminths were found in the rock pigeons faeces instead of one in the wood pigeon. The infection rate in rock pigeons was extremely high. In 50, 83% of wild pigeons (61/120) and in 30, 36% of wood pigeons (34/112). Oocysts of coccidia were detected ($P<0.05$) especially *Eimerialabbeana* and *Eimeria columbae*, the most listed species in

the fecal samples of the two types of birds. Eggs of helminth were identified in 20, 83% (25/120) of the faecal samples of wild pigeons and in 3, 57% (4/112) of the faecal samples of wood pigeons (P<0.05). Three different types of nematode eggs were also observed in both rock pigeons and wood pigeons. The most extended species among nematode eggs was *Capillaria sp*.

As shown in table 2, for both pigeons species, the endogenous infections due to one simple species (coccidian in particular) were more occurrent than mixed infections (coccidia + helminths). In the other hand, no single infections with helminth species were observed in the two types of pigeons.

Table 1: Prevalence of the Parasites Identified in the Feces of *Columba livia livia* and Columba Palumbus between March 2013 and February 2014 by the Method of Floating

Species	Rock Pigeon		Wood Pigeon	
Parameters	**Number of Infected Pigeons**	**n= 120 (%)**	**Number of Infected Pigeons**	**n=112 (%)**
Coccidia				
E. columbae	31	25,83	24	21,43
E. columbarum	22	18,33	7	6,25
E. labbeana	36	30	28	25
Helminths				
A. columbae	5	4,17	-	-
Capillaria sp.	25	20,83	8	7,14
Heterakis sp.	3	2,50	-	-

n: total number of fecal samples

Table 2: Type of Coccidial and Helminth Infections in Wild Pigeons (*Columba livia livia*) and Wood Pigeon (Columba Palumbus)

Species	Rock Pigeons		Wood Pigeon	
Infection type	x/n	%	x/n	%
Single infection (coccidia)	36/61	59,02	30/34	88,24
Mixed infection (coccidia + helminths)	25/61	40,98	04/34	11,76

x: number of infected pigeons; n : total number of infected pigeons.

During the evaluation of data, in regard with the infection by single or mixed species of parasite in the rock pigeons and wood pigeons, respectively, the following values of percentage were found: one species (14,8%, 29,4%), two species (34,4%, 50%), three species (27,9%, 14,7%) and four species (22,9%, 5,9%).

The results presented in **table 3** prove that the total prevalence of infestation was 29% in both sexes for rock pigeons, and that the intensity of infection concerning females was relatively higher (6, 94) than males (6, 78). Both male and female of wild pigeons had six endoparasitic species. Single infection (coccidia) and mixed infection (coccidia + helminths) showed respectively a rate of 38% and 12%. The highest infection intensity 14, 13 was found for *E.columbarum* in female's pigeons and 10, 33 of *E. columbae* for males. Concerning wood pigeons, the highest infection rate was 24% and 25, 8% respectively for males and females, and only four species of endoparasites were recorded. The intensity of *E. columbarum* was 14,5and 7, 4 of *E. columbae* for both males and females.

Table 3: Prévalence and Intensity of Endoparasites According to the Effect of the Sex and the Kind of the Pigeons

Species	Rock Pigeon (M=55, F=65)								Wood Pigeon (M=50, F=62)							
Parameters	nx		P (%)		ny		Mean Intensity		nx		P (%)		ny		Mean Intensité	
Sex	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
Coccidia																
E. columbae	12	19	21,81	29,23	124	137	10,33	7,21	10	14	20	22,58	74	108	7,4	7,71
E. columbarum	14	8	25,54	12,31	69	113	4,92	14,13	5	2	10	3,23	15	29	3	14,5
E. labbeana	11	25	20	38,46	86	104	7,81	4,16	12	16	24	25,81	33	61	2,75	3,81
Helminth																
A. columbae	1	4	1,81	6,15	8	23	8	5,75	0	0	0	0	0	0	0	0
Capillaria sp.	16	9	29,09	13,85	79	72	4,38	8	3	5	6	8,06	9	11	3	2,2
Heterakis sp.	1	2	1,81	3,08	7	16	7	8	0	0	0	0	0	0	0	0

F: female; M: male; nx: total number of infected pigeons; ny: total number of endoparasites.

The differences between the total intensity of infection for both males and females hosts were in most cases very low. This study reveals that gender is not a pertinent parameter in parasitic infections of pigeons. It was noted that the rates of infection of males and females in the two types of pigeons were very close to each other's, which make the sexual aspect statistically insignificant (P>0.05).

The highest infection of wild pigeons was noticed during the autumn. Indeed, high amount of *E. labbeana* was registered (53, 3%) during this period in contrast with *Capillaria sp*, which was relatively intense during winter (33, 3%). In parallel, for wood pigeons, significant infections were registered during the autumnal period but with lower values of which the highest was recorded for *E. columbae* (42, 9%). The *A. columbae* and *Heterakis sp.* were absents during spring and summer (Table 4). The rate of infection in autumn in rock pigeons proved rather high compared with the rate of infection of the wood pigeons (P<0.05).

Table 4: Variation of the Prevalences and Seasonal intensities of the Endoparasites Present in Feces of *Columba livia livia* (n=30) and Columba palumbus(n'=28)

Season			Spring (n=30, n'=28)				Summer (n=30, n'=28)				Autumn (n=30, n'=28)				Winter (n=30,n'=28)			
Pigeonsspecies	Endoarasites	Parasitespecies	Number of Host Infected	Prevalence (%)	Total Number of parasites Collected	Meanintensity	Number of Host Infected	Prevalence (%)	Total number of Parasites Collected	MeanIntensity	Number of Host Infected	Prevalence (%)	Total number of Parasites Collected	MeanIntensity	Number of Host Infected	Prévalence (%)	Total Number of Parasites Collected	MeanIntensity
Columbalivialivia	Coccidia	*E. columbae*	3	10	6	2	6	20	24	4	13	43,33	152	11,69	9	30	79	8,78
		E. columbarum	5	16,67	17	3,4	2	6,67	3	1,5	8	26,67	96	12	7	23,33	66	9,43
		E. labbeana	4	13,33	11	2,75	2	6,67	4	2	16	53,33	89	5,56	14	46,67	86	6,14
	Helminth	*A. columbae*	0	0	0	-	0	0	0	-	4	13,33	27	6,75	1	3,33	4	4
		Capillaria sp.	5	16,67	30	4,29	3	10	12	2,4	7	23,33	36	4,5	10	33,33	73	6,64
		Heterakis sp.	0	0	0	-	0	0	0	-	2	6,67	15	7,5	1	3,33	8	8
Columbapalumbus	Coccidia	*E. columbae*	3	10,71	16	5,33	1	3,57	3	3	12	42,86	98	8,17	8	28,57	65	8,13
		E. columbarum	0	0	0	-	0	0	0	-	5	17,86	38	7,6	2	7,14	6	3
		E. labbeana	7	25	19	2,71	4	14,29	7	1,75	10	35,71	43	4,3	7	25	25	3,57
	Helminth	*A. columbae*	0	0	0	-	0	0	0	-	0	0	0	-	0	0	0	-
		Capillaria sp.	1	3,57	2	2	0	0	0	-	4	14,29	14	3,5	3	10,71	4	1,33
		Heterakis sp.	0	0	0	-	0	0	0	-	0	0	0	-	0	0	0	-

DISCUSSIONS

The parasitic infections are responsible for serious problems of health in wild pigeons. So far, there is no study realized in Algeria on the prevalence and the intensity of gastro-intestinal parasites of pigeons. A total of 120 rock pigeons (55 males and 65 females) and 112 wood pigeons (50 males and 62 females) were studied. Two methods (quantitative and qualitative) were performed for the examination of the fecal samples. Through laboratory analyses, 61 out a total of 120 rock pigeons were infected by gastro-intestinal parasites against 34 out of 112 wood pigeons. The total prevalence of the helminths gastro-intestinal was 20, 8% in rock pigeons, whereas only 3,6% was found in wood pigeons. This presence of helminths (20, 8%) in rock pigeons appeared low compared to the studies of Basit and *Al* (2006) which found a total rate of the infestation equivalent to 60% for rock pigeons. In the same way, the total parasites prevalence found was much higher (74, 14%) according to the autopsy results of Marks and *Al* (2007) for rock pigeons (*Columba livia livia*). Patel and Al (2000) found 48,11% positive cases of gastro-intestinal parasites in the captive birds of the zoo of Goudjerate, a rate in agreement with the results of the current study.

The most common species of coccidia proved to be *E. labbeana*and *E. columbarum* in the studies already realized elsewhere in the world (Hunt and O' grady, 1976; Vindevogel and Duchatel, 1979; Levine, 1985; Kulisic, 1989; Kaleta and Bolte, 2000; Pilarczyk and Al, 2006), as well as *E. columbae* in India (Levine, 1985; Senthilvel and Pillai, 1995), Poland (Pilarczyk and Al, 2006), and Yugoslavia (Kulisic, 1989). However, *E. tropicalis* is only detected in India (Levine, 1985; Inci, 2001).

According to the fecal examinations', the most common species of nematodes are *Ascaridia columbae* and *Capillaria sp.* (Boado and Al, 1992; Ok and Al, 1997; Dovc and Al, 2004; Foronda and Al, 2004; Piasecki, 2006). Moreover, it is noted that the infections due to *Heterakis sp.* are common to other birds (Pavlovic, 2003). In Turkey, several studies about coccidiose and other helminth infections of pigeons were also achieved. Merdivenci, 1963, identified the following nematodes; *Capillaria obsignata* (19,3%) and of *Ascaridia columbae* (14,6%), in the wild pigeons nesting upon the famous mosques of Istanbul. A study conducted In Elazý (Turkey) revealed mixed infections of *E. labbeana* and *E. columbarum* in wild pigeons (15, 1%) (Koroglu and Simsek, 2001). In the same context, a study in Ankara identified three nematodes (*Capillaria columbae* (3, 5%), *Ascaridia columbae* (2%), and *Dispharynxnasuta* (0, 5%) in adults pigeons. The rate of infection determined at the autopsy was 10 times higher, and the number of species found was four times higher than those given during corporal examination (Gicik and Burgu, 2000).

In this study, the high rates of oocysts of *E. labbeana* and *E. columbarum* given for the rock pigeons and wood pigeons were in agreement with other studies realized in Turkey (Merdivenci, 1963; KorogluetSimsek, 2001); but with slightly high rates. The eggs of *Ascaridia columbae* and *Heterakis sp.* were only found in rock pigeons. However, species of *Capillaria sp.* was present in the two types of pigeons: rock and wood pigeon.

Wealso showed that the factor of gender is not relevant to coccidial or helminth infections for both types of pigeons, instead, the factor of seasons is statistically important. This difference could be due to the narrow association of male and female rock pigeons for food and flight, therefore the possibility of gastro-intestinal nematodes infection may come from the frequentation of the same environment. The research undertaken by (Gicik and Burgu, 2000; Senlik and Al 2005) concluded that there is no significant difference ($P<0.05$) between male and female wild pigeons in the total prevalence of the helminths.

On the other hand, autumnal infections were highest supporting the conclusion of Sari and Al (2008). These infections are more common to rock pigeons comparing to wood pigeons. Infection rates increase during autumn, decrease slowly in winter and almost disappear (Table 4). This confirms preceding studies (Senlik and Al 2005) where helminth infections were generally observed during autumn and winter because of the abundant rains with during warm winter which create a suitable environment for the infestation and the development of helminths eggs. Patel and *Al* (2000) found *Ascaridia sp.* (20, 75%) and *Capillaria sp.* (13,2%) in captive birds. This difference in the prevalence of the gastro-intestinal parasites is most of the time based on the geo-climatic conditions. The maximum rate of infection in the pigeons was seen in October (Sari and *Al* 2008).

CONCLUSIONS

Through the present study, coccidian oocysts and the helminths eggs were identified for the first time in Algeria. They were also found in many other birds species, thus we can consider that even the pigeons can actually be infected via direct contact with these animals. The responsible agents for the coccidioses, the ascariasis and the capillarioses in the rock pigeons are the same ones as those met in the wood pigeons. Consequently, for these diseases, there is no particular specificity of parasites in wild pigeons compared to other Columbidae. An eventual transmission of parasites, between wild pigeons of city, turtle-doves and carrier pigeons, is thus completely possible (Biscaichipy, 1989).

Specific precautions must be taken against the parasitic infections of the pigeons by considering that these animals are in liaison with the other poultry, of which we advise two strategic treatments per year; a first one in autumn, and a second in winter.

We conclude that coccidian oocysts and some species of nematodes are common to the wild pigeons in the Algiers Sahel. The prevalence of these infections to the pigeons can be better identified by carrying out more extended analysis in which autopsies would be accomplished in order to find other internal parasites and even external. However, other studies are necessary to determine the effect of the parasitic infections on the mortality of pigeons.

REFERENCES

1. Adang L.K. (1999).Some aspects of the biology of four columbidaespecies in Zaria, Nigeria. M.Sc. Thesis, Ahmadu Bello University, Zaria, Nigeria.
2. Basit T., Pervez K., Avais M. & Rabbani, I. (2006).Prevalence and chemotherapy of nematodes infestation in wild and domestic pigeons and its effects on various blood components. Journal of Animal and Plant Sciences 16: 1-2.
3. Benallal K. &Ourabia K. (1988). Monographie, géographiqueet géotechnique de la régiond'Alger (Recueil de notes). Ed. Off. Press. Univ., Alger, 109p.
4. BISCAICHIPY J-P. (1989).Etude comparative de deuxespèces de tourterelles: la tourterelle des bois (*Streptopeliatutur*) et la tourterelleturque (*Streptopeliadecaocto*). ThèseMédecineVétérinaire, Toulouse, n° 89, 81p.
5. Boado E., Zaldivar L. & Gonzales A. (1992).Diagnosis, report and incidence of diseases of the pigeon (*Columbalivia*) in Cuba. Rev. Cubana de CienciaAvicola, 19, 74-78.
6. Cheng T. (1973).General Parasitology. Academic press, New York, San-Francisco and London.

7. Chermette R. & Bussieras J. (1992). ParasitologieVétérinaire, 2: Protozoologie, Service Parasitologie (ed), ENV Alfort, 10-14, 41- 60.
8. Cooper J. E. (1984). A veterinaryapproach to pigeons. J. Small. Anim. Pract. 24, 505–516.
9. Dovc A., Zorman-Rojs O., Vergles-Rataj A., Bole-Hribovsek V., Krapez U. &Dobeic M. (2004).Health status of free-living pigeons (*Columbaliviadomestica*) in the city of Ljubljana. Acta Vet Hung, 52, 219-226.
10. Foronda P., Valladares B., Rivera-Medina J.A., Figueruelo E., Abreu N. & Casanova J.C. (2004). Parasites of *Columbalivia* (Aves: Columbiformes) in Tenerife (Canary Islands) and their role in the conservation biology of the laurel pigeons. Parasite, 11, 311-316.
11. Gicik Y. &Burgu A. (2000). Ankara vecevresindeyabanguvercinlerdehelmintfaunasi. KafkasUnivVetFakDerg, 6, 1-7.
12. Hall W. J. (1952).Diseases and parasites of poultry. Farmers' Bull. U.S. Dep. Agric. 1652, 45–84.
13. Harlin R.W. (1994). Pigeons. Vet Clin N Am: Small AnimPract, 24, 157-173.
14. Huchzermeyer F. W. (1978). An introduction to diseases of pigeons in South Africa. J. S. Afr. Vet. Assoc. 49, 107–108.
15. Hunt S. & O'grady J. (1976). Coccidiosis in pigeons due to Eimeria labbeana. AustVet J, 52, 390.
16. Inci A. (2001). Hindi, kaz, ordekvekuslardacoccidiosis. In: Coccidiosis, edited by S. Dincer, TurkiyeParazitolojiDernegiYayin No: 17, Izmir, pp. 177-199.
17. Kaleta E.F. &Bolte A.L. (2000).VorkommenundBekampfung der Kokzidiose der Tauben. PraktischerTierarzt, 81, 476-482.
18. Kaminjolo J.S., Tikasingh E.S. & Ferdinand G.A.A. (1988). Parasites of the common pigeon (*Columbalivia*) from the environs of Port of Spain, Trinidad. Bull AnimHealthProdAfrica, 36, 194-195.
19. Koroglu E. &Simsek S. (2001). The prevalence of Eimeriaspecies in pigeons (*Columbalivia*) in Elazig. F U SaglikBilDergisi, 15, 401-403.
20. Kulisic Z. (1989).Parasitical infection amongpigeons (*Columbalivia*) of different ages in the area of Belgrade. Acta Vet Beograd, 39, 155-162.
21. Levine N.D. (1985).VeterinaryProtozoology. Iowa State Univ. Press, Ames, pp. 200-201.
22. Merdivenci A. (1963). Istanbul camilerindeyuvalananguvercin (*Columbalivia*)'lerdeparazitinsidensi. TurkBiyolDerg, 13, 81-86.
23. Marques S.M.T., De Quadros R.M., Da Saliva R.M., Da Saliva C.J. & Baldo M. (2007). Parasites of pigeons (*Columbalivia*) in urban areas of lages, Southern Brazil. ParasitolLatinoam62: 183–187.
24. Nadeem M., KhanM.N., IqbalZ., SajidM.S., ArshadK. & YaseenM. (2007).Determinants influencing prevalence of louse infestations on layers of district Faisalabad (Pakistan). British Poultry Science. 48 (5): 546–550.

25. Ok U.Z., Girginkardesler N., Kilimcioglu A. & Limoncu E. (1997).Diskiincelemeyöntemleri. In: *ParazitHastalıklarındaTani*, edited by M.A. Ozcel and N Altintas, T ParazitolDernYay, EgeUniversitesiBasimevi, Bornova-Izmir, pp. 1-61.

26. Opara MN, Ogbuewu IP, Iwuji CT, Njokua L, Ihesie EK, & Etuka IF. (2012). Blood characteristics, microbial and gastrointestinal parasites of street pigeons in Owerri Imo State, Nigeria. Journal of Animal Science. 1; 14-21.

27. Patel P.V., Patel A.I., Sahu R.K. &Vyas R. (2000).Prevalence of gastrointestinal parasites in captive birds Gujarat Zoos. Zoo's Print Journal 15: 295-296.

28. Pavlovic I., Dobrila J.D., Kulisic Z. & Iulia F. (2003). Most frequentnematode parasites of artificiallyraisedpheasants (*Phasianuscolchicus*L.) and measures for their control. Acta Vet Beograd, 53, 393-398.

29. Piasecki T. (2006). Evaluation of urban pigeon (*Columbia livia* f. urbana) health status in relation to their threat to human's health. MedycynaWet, 62, 531-535.

30. Pilarczyk B., Balicka-Ramisz A., Ramisz A. &Laurans L. (2006).Effect of Baycoxcoccidiostat on coccidia infection in pigeons. Ann AnimSci, 6, 331-336.

31. Pellerdy L.P. (1974).Coccidia and Coccidiosis. Verlag Paul Parey, Berlin-Hamburg.

32. Sari B., karatepei B., Karatepei M., & Kara M., (2008). Parasites of domestic (*Columbaliviadomestica*) and wild (*Columbalivialivia*) Pigeons in Nigde, Turkey. Bulletin of the Veterinary Institute in Pulawy52: 551-554.

33. Senlik B., Gulegen E. &Akyol V. (2005).Effect of age, sex and season on the prevalence and intensity of helminth infections in domestic pigeons (*Columbalivia*) from Bursa Province, Turkey. Acta Vet Hung, 53, 449-456.

34. Senthilvel K. & Pillai K.M. (1995). Coccidiosis of domesticpigeons (*Columbaliviadomestica*). J VetAnimSci, 26, 73-74.

35. Soulsby E. J. L. (1982).Helminths, Arthropods and Protozoa of Domesticated animals. 7th Edition, London.

36. Soulsby E.J.L. (1986).Helminths, Arthropods and Protozoa of Domesticated Animals. Bailliere and Tindall, London.

37. Tinar R. (2006).Helmintoloji. Nobel Yayin No: 965, 1. Basim, Ankara.

38. Vindevogel H. & Duchatel J.P. (1979). Les principales maladies parasitaires du pigeon. Ann Med Vet, 123, 85-92.